Voyager Bulletin

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"An exciting, rewarding year has drawn to a close, and I would like to thank the Voyager Flight Team members and all the support groups for a job exceptionally well done. The results from Jupiter have sparked the world's interest and imagination. An equally challenging and exciting goal lies before us this year – Voyager 1's encounter with Saturn. With your continued dedicated support, I am sure we will be able to satisfy the high expectations established by our Jupiter successes."

Ray Heacock
Voyager Project Manager

Update

Voyager 1 Operations Back to Normal

Voyager 1's operations returned to normal on December 20, 1979, nearly seven days after the Saturn-bound spacecraft failed to re-orient its antenna toward Earth at the end of a course correction on December 13.

Currently 970 million kilometers (602 million miles) from Earth, Voyager 1 is Earth-oriented, responding to commands, and transmitting data. All science instruments are operating normally, and the trajectory correction itself was successful.

Voyager 1's failure to re-establish communications with Earth by regaining its celestial references has been traced to an internal communications error in the spacecraft. The combination of a mode change command word which violated computer sequencing constraints and a parity error touched off a series of events which caused the pre-programmed re-orientation sequence to halt. Since launch in September 1977, Voyager 1 has communicated over 37 million commands between the CCS and AACS (two on-board computers) with no previous parity error, which involves a bit-count check in the computer software.

The first indication of problems came at approximately 2:15 p.m. (PST) on December 13, when the Deep Space Network tracking stations did not receive the spacecraft signal as expected after the course correction. The maneuver is performed in a radio blackout since the high-gain antenna dish is turned away from Earth. A faint signal was detected through the DSN's special radio science equipment, and was tracked throughout the recovery.

At various times, commands were sent to switch the spacecraft's receivers and S-band transmitter from the high-gain antenna to the low-gain antenna, which has a much broader beamwidth.

During interplanetary cruise, the spacecraft normally stabilizes itself by tracking the Sun and the reference star Canopus. However, following the sequence abort, the spacecraft was stabilized by its internal gyros and was Sun-pointed only. It was initially assumed that the spacecraft was tracking a star other than Canopus, but two attempts to re-orient the spacecraft from possible stars failed.

On December 16, commands were sent to perform a "sun cone", searching for Earth by rotating the antenna around the Sun with an 8° offset, stopping at sixteen different points. At the third point, ground stations picked up a strong signal as the high-gain antenna beam swept across the Earth. Six minutes of data were received before the sequence continued to the next point. At completion of the search sequence, Voyager 1 was commanded back to the third point, and the signal was received by the Australian tracking station nearly 72 hours after the emergency began.

After analysis of the spacecraft's tape-recorded and computer memories data from the course correction and sequence abort, the spacecraft was commanded to return to its reference star Canopus on December 19, and by noon on December 20, all systems aboard Voyager 1 had been returned to normal.

Photopolarimetry Expected at Saturn with Voyager 2

Tests of Voyager 2's photopolarimeter on January 2, 1980, indicate that the instrument is stable and capable of limited operation. The instrument, which studies reflected sunlight to determine atmospheric, surface, and ring composition, will operate in two modes at Saturn (August 1981), collecting both color and polarization data. Earlier in the flight, the PPS experienced problems with its polarization analyzer wheel, and may have component damage due to Jupiter's intense radiation.

Voyager 1's photopolarimeter was declared inactive in December 1979 after tests indicated that its photomultiplier tube, which converts weak light signals to strong electrical signals, has virtually no sensitivity remaining. This fact, combined with an electrical problem in the motor drive circuit which turns the instrument's light analysis wheels, resulted in the decision to abandon the instrument. Analysts concluded that there would be little or no scientific value in any data this instrument could return.

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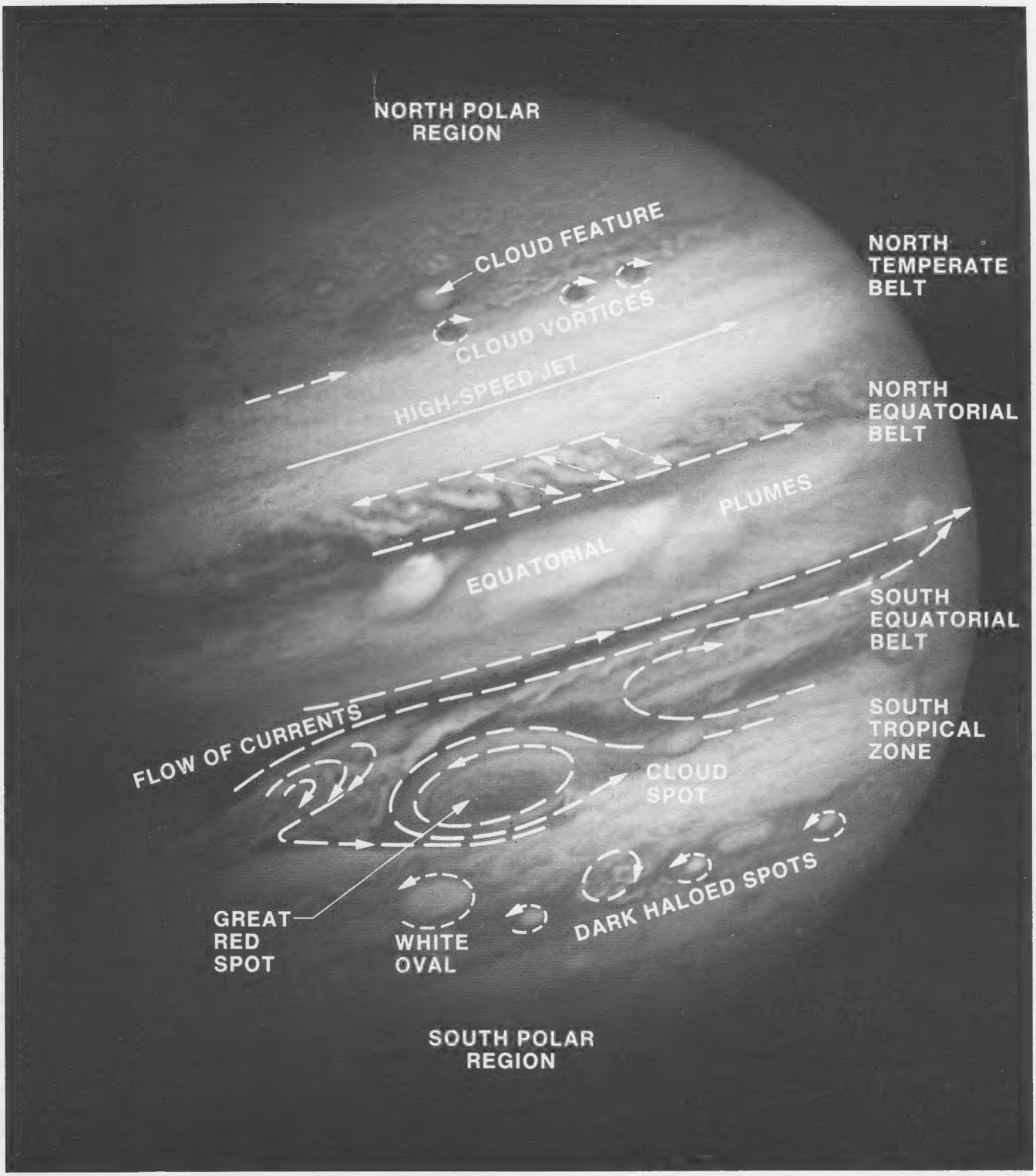
NORTH POLAR REGION
CLOUD FEATURE
CLOUD VORTICES
HIGH-SPEED JET
NORTH TEMPERATE BELT
NORTH EQUATORIAL BELT
PLUMES
EQUATORIAL
SOUTH EQUATORIAL BELT
FLOW OF CURRENTS
SOUTH TROPICAL ZONE
CLOUD SPOT
GREAT RED SPOT
WHITE OVAL
DARK HALOED SPOTS
SOUTH POLAR REGION